REMARKS

The Official Action dated August 12, 2004 has been received and its contents carefully noted. In view thereof, claim 16 and 20 have been canceled, claims 1, 18 and 21-24 have been amended and new claims 25-28 have been added in order to better define that which Applicants regard as the invention. Accordingly, claims 1, 10, 13-15, 17-19 and 21-28 are presently pending in the instant application.

Initially, Applicants wish to acknowledge the Examiner's indication that claim 23 would be allowable if rewritten or amended to overcome the rejection under 35 U.S.C. §112, second paragraph set forth in the Office Action. As can be seen from the foregoing amendments, independent claim 23 has been amended in order to better define that which Applicants regard as the invention. Accordingly, it is respectfully submitted that this claim is now in proper formal condition for allowance.

With reference now to the Official Action and particularly page 2 thereof, claims 18-22 and 24 have been rejected under 35 U.S.C. §112, first paragraph as failing to comply with a written description requirement. Particularly, the Examiner states that the claims contain subject matter which was not described in the specification in such a way to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. That is, the Examiner is of the position that the specification never discloses the multilayer structure as being made of metal nitride films as claimed in claim 18 nor does it disclose the multilayer structure being made up of metal oxide films and metal nitride films as claimed in claims 21 and 24.

In this regard, it is noted that the specification at page 7, lines 9 and 10 as well as page 14, lines 14 and 15 clearly disclose the multilayer structure being made up of metal oxide and metal nitride films. Accordingly, as can be seen from the foregoing amendments, each of claims 18, 21 and 24 have been amended in order to recite claimed features which are clearly supported by the specification. Particularly, reference to a metal oxide film has been deleted from the claims. Accordingly, it is respectfully submitted that each of claims 18, 21 and 24 are now in proper condition for allowance.

With reference to paragraph 2 of the Office Action, claims 16, 21 and 23 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In this regard, as can be seen from the foregoing amendments, claim 16 has been canceled and consequently, further discussion with respect thereto is no longer believed to be warranted. With respect to claims 21 and 23, as can be seen from the foregoing amendments, each of these claims have been amended in order to clarify that which is presently forth by Applicants' claimed invention. Accordingly, it is respectfully submitted that each of claims 21 and 23 are now in proper formal condition for allowance.

With reference now to paragraph 3 of the Office Action, claims 22 and 24 have been objected to as including minor informalities. Again, as can be seen from the foregoing amendments, each of these claims have been amended in order to clarify that which is presently set forth by Applicants' claimed invention. Accordingly, it is respectfully submitted that each of these claims are now in proper formal condition for allowance.

In paragraph 5 of the Office Action, claims 1, 10 and 14-20 have been rejected under 35 U.S.C. §102(e) as being clearly anticipated by U.S. Patent No. 6,515,323 issued to Jung et al. This rejection is respectfully traversed in that the patent o Jung et al. neither discloses nor remotely suggests that which is presently set forth by Applicants' claimed invention.

With the foregoing amendments to independent claims 1 and 18, the present invention is directed to a semiconductor device in which the contact layer is composed of a single-layer film or a multilayer structure, the single-layer film being made of a metal oxide or a metal nitride, the multilayer structure being made of metal oxide and metal nitride films, is provided between the upper electrode and the insulating film so as to improve the adhesiveness between the upper electrode and the insulating film covering the capacitants. Specifically, as illustrated in Fig. 1, the contact layer is provided on the upper electrode so as not to be in contact with the capacitive insulating film and in a region other than the region where a metal interconnect is connected to the upper electrode. Additionally, the insulating film which is made of silicon dioxide or silicon nitride is formed directly on the contact layer. This feature being supported by page 12, lines 7-9 of the present specification.

Consequently, since the top surface of the upper electrode is not in contact with the insulating film, the pealing of the insulating film from the upper electrode due to high temperature annealing can be prevented. Furthermore, since the contact layer is composed of a single layer film of a multilayer structure, of which the single-layer film is made of a metal oxide or a metal nitride and the multilayer structure is made metal oxide and metal nitride films, diffusion of metal atoms of the contact layer into the upper electrode due to the annealing performed after the forming of the contact layer can also be prevented. As the

Examiner can readily appreciate, the present invention results in a semiconductor device which has the effect of preventing the pealing off of the insulating film and surpressing the metal atoms from reaching the capacitive insulating film by way of the upper electrode and thus prevents the degradation inpolarization properties of the ferroelectric film which is not achieved by the prior art cited by the Examiner.

Particularly, with respect to U.S. Patent No. 6,515,323 issued to Jung et al., the insulating film 134 (or 124) is not formed directly on the mask layer 120, while the insulating film of the present invention as noted hereinabove is formed directly on the contact layer. Furthermore, in accordance with the teachings of Jung et al., the TiO_2 barrier film 122 is formed directly on the mask layer 120 to prevent a shift in the composition of the ferroelectric film PZT caused by the diffusion of mainly Pb within the PZT into the capacitor protective film or insulating film during the subsequent annealing step. Hence, Jung et al. discloses a device having the effect of preventing the shift in the PZT composition, and thus prevents a degradation in properties. With the teachings of Jung et al., if the barrier film 122 is substituted with a silicon oxide film, the diffusion prevention function of the barrier film will be lost and Pb diffusion will occur, thus the shift in composition of the ferroelectric film cannot be prevented. It is further noted that the semiconductor device of the present invention is mainly Sbt and thus does not suffer from the problems of that set forth in the Jung et al. reference.

Accordingly, in that each of independent claims 1 and 18 recite an insulating film made of silicon dioxide or nitride formed directly on the contact layer to cover the lower electrode, the capacitive insulating film, the upper electrode and the contact layer which is

nowhere to be found in the Jung et al. reference, it is respectfully submitted that each of independent claims 1 and 18 as well as those claims which depend therefrom clearly distinguish over the teachings of Jung et al. and are in proper condition for allowance.

Referring now to paragraph 7 of the Office Action, claim 13 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Jung et al. in view of U.S. Patent No. 6,586,790 issued to Kanaya et al. This rejection is respectfully traversed in that the combination proposed by the Examiner neither discloses nor suggests that which is presently set forth by Applicants' claimed invention.

While the patent to Kanaya et al. may disclose a ferroelectric film $SrBi_sTa_sO_9$, this reference clearly fails to overcome the aforementioned shortcomings associated with the Jung et al. reference. As discussed in detail hereinabove, independent claim 1 upon which dependent claim 13 depends recites an insulating film made of silicon dioxide or nitride formed directly on the contact layer to cover the lower electrode, the capacitive insulating film, the upper electrode and the contact layer. Accordingly, because dependent claim 13 includes all the limitations of independent claim 1, such limitations which are neither disclosed in nor suggested by the combination proposed by the Examiner, it is respectfully submitted that dependent claim 13 is likewise in proper condition for allowance.

With reference now to paragraph 9 of the Office Action, claims 21, 22 and 24 have been rejected under 35 U.S.C. §102(b) as being clearly anticipated by Japanese Patent Publication 11-307733 issued to Miyasaka et al. This rejection is likewise respectfully traversed in that the Japanese Patent Publication to Miyasaka et al. neither discloses nor suggests that which is presently set forth by Applicants' claimed invention.

Initially, as can be seen from the foregoing amendments, each of independent claims 21 and 24 have been amended to recite that a portion of the upper surface of the capacitive insulating film is covered by the insulating film. That is, in order to improve the adhesiveness between the upper electrode and the insulating film covering the capacitance, the contact layer composed of a single-layer film or a multilayer structure, the single-layer film being made of a metal oxide or a metal nitride, the multilayer structure being made of metal oxide and metal nitride films, is provided between the upper electrode and the insulating film, and a portion of the upper surface of the capacitive insulating film is covered by the insulating film. Support for such limitation is found at page 17, lines 11-16 as well as Fig. 1A.

In doing so, since the top surface of the upper electrode is not in contact with the insulating film, the pealing off of the insulating film from the upper electrode due to high temperature annealing and the like can be prevented. Moreover, since the contact layer is composed of a single-layer film or a multilayer structure, of which the single-layer film is made of a metal oxide or a metal nitride film, diffusion of metal atoms in the contact layer into the upper electrode due to the annealing performed after forming the contact layer can be prevented. Consequently, the present invention has the effect of preventing the pealing off of the insulating films and surpressing the metal atoms from reaching the capacitive insulating films by way of the upper electrode and thus prevent degradation in polarization properties of the ferroelectric film.

Furthermore, as noted hereinabove, since the contact layer is provided on the upper electrode and a portion of the upper capacitive insulating film is covered by the insulating

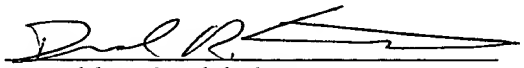
film, a large portion of the surface of the lower electrode is covered by the capacitive insulating film and the contact area between the insulating film and the capacitive insulating film is large. Hence, the pealing off of the insulating film from the lower electrode and from the upper electrode can be suppressed. With respect to the teachings of Miyasaka et al., it is noted that this reference discloses forming a contact layer on an upper electrode. However, in accordance with Miyasaka et al., the capacitor is formed by simultaneously patterning a capacitive insulating film and the upper electrode, and the lower electrode composed of Pt and an insulating film are in direct contact with one another. In other words, Miyasaka et al. discloses a structure which exhibits the specific problem which the present invention is intended to solve, such that the pealing off of insulating film from the electrode composed of Pt increases. On the other hand, as discussed hereinabove and in accordance with the present invention, since the upper electrode and the capacitive insulating film are patterned separately, each end surface is not continuous with the others and the pealing off of the insulating film from the electrode can be suppressed. Accordingly, for the foregoing reasons it is respectfully submitted that teach of independent claims 21 and 24 which recite a portion of the upper surface of the capacitive insulating film being covered by the insulating film clearly distinguishes over the teachings of Miyasaka et al. and are in proper condition for allowance.

With respect to new claims 25-28, each of these claims are directly dependent upon one of independent calm 1, 18, 21 or 24 and consequently are believed to be proper condition for allowance for the reasons discussed hereinabove.

Therefore, in view of the foregoing it is respectfully requested that the objections and rejections of record be reconsidered and withdrawn by the Examiner, that claims 1, 10, 13-15, 17-19 and 21-28 be allowed and that the application be passed to issue.

Should the Examiner believe a conference would be of benefit in expediting the prosecution of the instant application, he is hereby invited to telephone counsel to arrange such a conference.

Respectfully submitted,



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